

ZOOLOGICAL SOCIETY.

Jan. 11, 1848.—William Yarrell, Esq., Vice-President, in the Chair.

The following communications were read:—

1. ON THE REMAINS OF THE GIGANTIC AND PRESUMED EXTINCT WINGLESS OR TERRESTRIAL BIRDS OF NEW ZEALAND (*DINORNIS* AND *PALAPTERYX*), WITH INDICATIONS OF TWO OTHER GENERA (*NOTORNIS* AND *NESTOR*). BY PROFESSOR OWEN, F.R.S. ETC. ETC.

In this memoir (No. III.) Professor Owen confined himself to the description and comparison of the bones of the head and beak, forming part of a very extensive and valuable series collected by Mr. Walter Mantell in a deposit of volcanic sand at Waingongoro, North Island of New Zealand. After enumerating the principal bones, now in the possession of Dr. Gideon Mantell, F.R.S., by whom Prof. Owen had been kindly invited to determine and describe them, and stating the species to which the majority were referable, viz. *Dinornis giganteus*, *D. casuarinus*, *D. didiformis*, *D. curtus*, *Palapteryx ingens*, *P. dromioides*, *P. geranoides*, the author alluded to a form of tarso-metatarsal bone, which had supported a strong back-toe, and resembled the metatarsus of the Dodo, but was shorter and thicker, as apparently belonging to the tibia of the species described in a former memoir (Zool. Trans. iii. 1843, p. 247), to the *Dinornis otidiformis*, but which must belong to a genus (*Apterornis*) distinct from both *Dinornis* and *Palapteryx*. He also stated that the collection contained many bones of seals of the genus *Arctocephalus*, F. Cuv., with a few bones of a dog and of the human subject: the latter had been calcined, and were probably the remains of some cannibal feast of the natives. The uncalcined bones of the seal were in the same state, brittle, absorbent, and of a yellowish brown colour, as the bones of the extinct birds, with which they were associated and appear to have been coeval. Numerous fragments of the shells of more than one kind of egg, the largest surpassing in size the egg of the ostrich, had also been discovered with the bones.

In the present memoir Prof. Owen described the bones of the head and beak. They belonged to four distinct genera of Birds. The largest skull, with a very strong, broad, subelongate and subincurved beak, like an adze, was referred to the genus *Dinornis*. The second in size, with a beak to which that of the Emeu makes the nearest approach, was referred to *Palapteryx*. The third skull, with a beak like that of the *Porphyrio* and *Brachypteryx*, was referred to the same family—'Rallidæ'—to which those genera belong; but, through the peculiarities of the cranium, formed the type of a new genus, *Notornis*. The fourth form of beak was referable to the genus *Nestor* in the family *Psittacidæ*.

The cranium of the *Dinornis* presents the family characters of great breadth, and forward inclination of the occipital region, of the vertical plane of the occipital foramen, and of the prominent and pedunculate occipital condyle; but the downward development of the basi-

occipital and basisphenoid is exaggerated, as compared with the *Palapteryx*, the basis cranii, which is $2\frac{1}{2}$ inches in length, descending abruptly for the extent of 1 inch below the foramen magnum; the condyle is hemispherical as in *Otis*, not a quarter of a sphere as in *Struthio* and *Palapteryx*, nor, as in *Didus*, a transverse reniform tubercle with a median notch above. The foramen magnum is a vertical ellipse, with lateral processes encroaching upon it, as in *Didus*; but in this large extinct bird the upper half of the foramen is narrower and almost pointed above. In *Apteryx* and *Palapteryx* the foramen is widest transversely. The margin of the foramen magnum is broad and excavated in both *Dinornis*, *Otis* and *Didus*, but the upper border ends in the latter genus in a tubercle on each side.

In *Didus* there is a small middle supraoccipital foramen and two lateral ones, but these do not exist in *Dinornis*, *Otis*, or *Palapteryx*: the lateral foramina are present in *Apteryx*.

In the extinct genera and in *Otis* the supraoccipital ridge is well-marked, but defined rather by the subsidence of the occipital surface than the elevation of the ridge above the parietal one.

In no bird is the extent of surface for muscular attachment so great at the back part of the head, or so strongly marked by depressions and ridges, as in the *Dinornis*.

The extension of the surface by the downward thick wedge-shaped development of the basi-occipito-sphenoidal surface, and by its lateral strong backwardly produced ridges, is quite peculiar to the *Dinornis*. An approach to this structure is made by *Otis* in the ridges that connect the sides of the flat basisphenoid* with the paroccipital* processes. In *Palapteryx* the basi-sphenoid is square and flat below, in *Didus* it presents a longitudinal channel bounded by parallel lateral ridges; the sides of the basisphenoid, which incline to these ridges, are slightly concave, have two perforations posteriorly, one above and a little in advance of the other, and form the anterior and internal boundary of the tympanic cavity.

In *Palapteryx*, as in *Didus*, the basioccipital descends and expands into two thick obtuse processes, from which muscles pass to the inwardly-bent angles of the jaw. Internal to these processes are two short tubercles. On each side the base of the occipital condyle in *Dinornis* are three small foramina; in *Didus* two, the outer one the largest.

In *Dinornis*, *Otis* and *Didus*, two foramina, the upper one for the hypoglossal nerve, the lower one for the entocarotid artery, open externally in a deep elliptic depression. The paroccipital is enormously developed in *Dinornis*, and sends a rough thick process from its under part to abut against the lateral basioccipital ridge, where it articulates and sometimes anchyloses with the stylohyal: in *Palapteryx* and *Didus* the paroccipital carries the posterior surface of the skull downwards and outwards in a minor degree than in *Dinornis*, and terminates in a curved convex thick border: its internal surface next

* For the definition of these and other anatomical terms the author referred to his 'Report on the Homologies of the Vertebrate Skeleton' in "Report of British Association, 1846."

the tympanic cavity is cellular in *Didus*. The eustachian outlets open, in both *Dinornis* and *Otis*, above a transverse ridge terminating the basisphenoid anteriorly: this ridge is not present in *Apteryx* or *Palapteryx*. The *Palapteryx* also differs from *Dinornis* in the higher position of the precondyloid holes and their greater separation from the carotid holes, in the minor development of the paroccipitals, the major development of the mastoids, and by the large and single oblong depression, beneath the mastoid, for the single superior condyle of the tympanic bone. In *Dinornis* the temporal fossa is wide and deep, in *Didus* narrow and deep; the alisphenoid is concave where it ascends to coalesce with the mastoid, parietal and postfrontal to form the temporal fossa: the limits of the orbitosphenoid are also obliterated by a similar confluence: in this region of the skull the 'foramen ovale' is preceded in *Dinornis* as in *Didus* by two smaller foramina, and in front of these is the great 'foramen opticum.' The parietals are very broad and short in both extinct genera; but in *Dinornis* there is a median rising where the sagittal suture originally ran, whilst *Didus* shows a depression and foramen here. The mastoid in *Dinornis*, as in *Otis*, sends down two processes, one, the tympanic process, short,—the other, or proper mastoid process, long; this coalesces with the postfrontal in *Dinornis*, not in *Otis*: the base of the mastoid has two articular cavities for the upper condyles of the tympanic bone. In *Didus* the outer side of the mastoid is convex, smooth, but with a slight oblique ridge; it overhangs the tympanic cavity, bending inwards, and sends a short compressed pointed mastoid process in front of the anterior articular cavity for the anterior and upper condyle of the tympanic.

The presphenoid is a deep compressed plate, thickened and rounded below; the palatines abut against it, as in *Didus*, where the fore-part of the pterygoids also rest in part upon the presphenoid. The frontals of *Dinornis* form together a broad hexagonal plate moderately convex, with the cerebral hemispheres indicated by very slight risings: the postfrontals form the depressed lateral angles; the anterior border is emarginate and coalesces with the nasals and premaxillary, without being elevated above them. In *Palapteryx* the frontals are more produced anteriorly before coalescing with the base of the beak. In *Otis* the interorbital part of the frontals is deeply and widely excavated. In *Didus* the frontals are broad and convex, rising singularly above the cranial ends of the nasals and premaxillary, with which they also coalesce. The supraorbital plate presents a rough notch near the fore-part, where in *Dinornis* there is a shallow emargination. In *Dinornis* there is a shallow depression with vascular grooves at the outside of the base of the postfrontal distinct from the temporal fossa: in *Didus* the temporal fossa extends forwards above the postfrontal and forms there a reniform depression, either for a gland, or what is less likely, for a co-extension of the origin of the temporal muscle. The postfrontal is a strong triangular obtuse process, ending freely as in *Palapteryx*, not joined to the mastoid as in *Dinornis*. The orbitosphenoids, indicated by the optic foramina, continue the roof and septum of the orbits by coales-

cence with the alisphenoids behind, the frontals above, the prefrontals in front, and the presphenoid below : they send a ridge upwards and outwards to the under part of the postfrontals, but do not present that singularly swollen character which is so peculiar in *Didus* ; in which also the prefrontals form a large smooth protuberance, like a tumour, at the fore-part of the orbits, and appear on the upper surface of the cranium in front of the antorbital process of the true frontal and external to the lachrymal. The interorbital bony septum is entire in both *Dinornis* and *Didus* ; but in the latter it is more than an inch in thickness and cellular, and in this respect more resembles the singular structure of the part in *Apteryx*. The orbits are smaller in *Dinornis* than in the large existing *Struthionidæ* or in *Otis*, but are larger than in *Apteryx*. The olfactory chambers in *Dinornis* are less developed than in *Palapteryx* and *Apteryx*.

The nasal bones in *Dinornis* and *Otis* converge where they overlap the prefrontal (*ethmoide*, Cuv.) in order to join the frontal and include that end of the nasal process of the premaxillary, which is on a lower plane ; and, as they advance, they pass beneath that process, coalesce with it and with each other, and terminate in *Dinornis* in a point. In *Didus* the nasals also anchylose with the frontal, where they are separated by the nasal process of the premaxillary, as indicated by the two longitudinal fissures, which, commencing behind at 2 lines distance from the outer border of the anchylosed base of the beak, gain that border at 1 inch 9 lines distance from the frontal, and thus indicate the proportions of the base formed by the anchylosed nasals : the fissure can also be traced as in *Dinornis*, bending inwards upon the under surface of the nasal process of premaxillary, to about 3 inches from the frontal, when the fissure returns back, inclining to the median line, and meets its fellow there. All the outer part of the median stem or base of the beak defined by these linear furrows I regard as the nasals, which thus support the nasal process of the premaxillary.

This process is a broad transversely arched plate, where it joins the maxillary processes to form the anterior or rostral part of the premaxillary ; the extent of which, anterior to the external nostrils, is $2\frac{1}{2}$ inches, the whole length of the premaxillary being $4\frac{1}{2}$ inches. Its breadth at the middle is rather more than an inch ; the depth of the upper bony beak gradually decreases from its base where it is 1 inch 9 lines, to its apex where it is less than 1 line, but retains a breadth of 8 lines, the edge appearing to have been truncate or very slightly rounded off : the whole upper beak being gently arched to this terminal edge resembles the cooper's adze (*doloire*, Fr.). The palatal surface is broad, very slightly excavated, and bounded laterally by well-defined alveolar ridges : the palatal nostril commences anteriorly 1 inch 10 lines from the anterior border of the premaxillary. In *Didus* the nasal process of the premaxillary presents an elliptic transverse section where it quits the maxillary processes, and diminishes in depth as it retrogrades, becoming depressed and broad where it rests upon and divides the nasals to anchylose with the frontal. Where the nasal and maxillary processes diverge,

there is a deep groove externally terminating in a canal directed forwards into the rostral part or body of the premaxillary ; this part is subincurved, pointed, rough and with irregular vascular perforations, with a sharp inferior border on each side, and a more concave palatal surface than in *Dinornis*. The long and slender palatines of *Dinornis* coalesce behind with the vomer and in front with the maxillaries ; they are concave below, particularly at their back part, by the downward extension there of their inner border. In *Didus* the palatines arch outwards from their posterior attachments, are broad and smooth mesially with a sharp crenate edge above ; a thin, outwardly smooth, convex ridge is directed outwards and downwards, and a more angular ridge is directed downwards with an obtuse apex : a groove divides this from the outer ridge : the upper and outer ridge extends to the maxillary ; the lower ridge subsides before it reaches the maxillary. The palatines form the boundaries of the naso-palatine aperture, and approximate each other at both their ends, but do not meet. There is a fossa at the outer and near the back part of each palatine, where there is a rough concavity ; the rest of the outer surface is convex lengthwise, concave vertically. The boundaries of the maxillary are more readily traceable in *Didus* than in *Dinornis* ; but they have coalesced in both, with the palatine, malar and lachrymal behind, and with the maxillary process of the premaxillary in front : the maxillary in *Didus* forms a compressed longitudinal plate of bone with thick rounded borders above and below, and almost touches its fellow, leaving a deep narrow chink between the nasal fossa above and the palate below, closed by the palatal membrane.

The tympanic bone of the *Dinornis* has more a triangular than a quadrate form by reason of the unusually large size of its inferior condyle, which forms its base : the orbital process is a compressed subrhomboidal plate : the lower condyle is not so extended inferiorly in the Bustard (*Otis*) ; its upper condyle is bifid, as in *Dinornis*. In *Palapteryx* it is single, as in *Apteryx*. In *Didus* the tympanic bone is subquadrate with the four angles produced, and the upper and hinder one bifurcate, forming the bifid condyle for the mastoid articulation : in *Dinornis* the mastoid condyle is also double, with a linear strip of bone between ; and behind this the pneumatic foramen, where also similar foramina are situated in *Didus* : in this extinct bird, the orbital process, forming the anterior angle, is compressed and truncate : the outer surface of the bone is smooth and convex vertically ; the inner surface is traversed by a sharp concave ridge extending from the inner division of the upper condyle to the anterior part of the inner and lower angle : the anterior division of the inner surface is concave, the posterior one is concave vertically, convex transversely. The antero-posterior extent of the condyle for the lower jaw is little, but greatest at its outer part, where it rests upon the shallow reniform outer division of the concave articular part of the lower jaw : the inner, more ridge-like part of the condyle sinks into a deeper transversely extended depression of the same articular concavity. The tympanic of the *Dinornis* chiefly differs in

the great extension, upwards and backwards, of the broad and undivided inferior condyle: there is also an articular surface, on its outer side, for the mastoid process (not present in *Otis*) and another small one on the inner side for the pterygoid; besides the lower and outer cup for the end of the slender zygoma (squamosal).

The inner angle of the expanded articular end of the lower jaw of *Dinornis* ends by a short obtuse process. In *Otis* and *Didus* it forms a strong trihedral process, the anterior and posterior facets meeting a transverse ridge below, which is continued into a compressed plate forming the posterior angle of the jaw. The posterior surface is smooth and slightly concave, semioval in *Dinornis*, deeper and subtriangular in *Didus*.

The outer part of the articular end of the mandible is smooth and convex in *Dinornis*: in *Didus* a masseteric ridge is continued downwards and forwards from the outer overhanging border of the articular cavity to the back and lower angle of the dentary piece, defining, with the posterior border of the dentary, a concave, slightly pitted surface. The surangular in *Dinornis* has a short and low thick coronoid ridge, external to which there is a rough oval surface. In *Didus* the surangular develops a very small coronoid process, and its fore-part is deeply notched: a deeper and more angular notch divides the surangular from the angular piece. This notch receives the lower fork of the dentary on the outside, and the end of the splenial at the inner side. These notches do not exist in *Dinornis*: the surangular, angular and articular pieces have coalesced together in both the extinct birds. Where they join the posterior forks of the dentary piece, a long narrow vacuity is left, which in *Dinornis* is almost divided by a broad bar of bone extending upwards from the angular, but which does not quite touch the surangular. In *Didus* the upper fork of the dentary joins the upper and fore part of the surangular; the notch between the hinder forks of the dentary bounds anteriorly the narrow elliptic vacuity, 15 millimeters long by 3 millimeters deep. A notch also extends forwards, and divides outwardly the symphyseal from the ramal part of the dentary: this notch or hole does not exist in *Dinornis*.

The parts of the bones of the beak referred to *Palapteryx* consist of the anterior end of the premaxillary and of the symphysis and part of both rami of the mandible. The premaxillary, by the proximity of the external nostrils to its apex, and by the nasal grooves continued thither on each side from the anterior boundary of the nostrils, resembles that of the large existing *Struthionidae*, and the Emeu more especially by the slenderness of the nasal process of the premaxillary and the angle at which it rises from the broad and flat maxillary processes. The end of the beak was, however, more obtuse than in the Emeu, and the short symphysis of the lower jaw is more deeply excavated above: it presents, however, the two parallel longitudinal grooves on its under part, as in the Emeu and Ostrich. The lower jaw appears from the remains of one ramus to have been 5 inches or $5\frac{1}{2}$ inches in length, and to have been broader and deeper than in the Ostrich or Emeu: and the cranium by its greater breadth

behind, its less depth, its vertical foramen magnum and prominent occipital condyle, the lower position of the basisphenoidal platform, and the marked angle which it forms with the almost vertical basioccipital, concurs with the beak in establishing the generic distinction of the great bird to which it belonged. As the characters which were adduced in a former memoir (Zool. Trans. iii. p. 327) to separate those bones of the extremities that by their more slender proportions approximated the *Struthionidæ* and, by the indication of a small back-toe, the *Apteryx* more particularly, from other bones of corresponding size but more robust proportions and devoid of a back-toe,—led to the former being assigned to the genus *Palapteryx*, and the latter to *Dinornis* proper;—so the characters which, in the first of the skulls described in the present memoir, show a departure from the struthious type, and in the second skull an approach thereto, clearly indicate the propriety of assigning the one to the genus *Dinornis* and the other to the genus *Palapteryx*. The total length of the skull referred to *Palapteryx geranoides* is 6 inches at least; the breadth of the cranium $2\frac{1}{2}$ inches: the bird probably equalled the Emeu in size.

The skull which indicates the third genus of apparently extinct bird (*Notornis*) measures $4\frac{1}{2}$ inches in length, and the cranium is 1 inch 8 lines in breadth. The bones of the beak closely resemble in form and structure those of the Purple Coot (*Porphyrio*), but the occiput is relatively broader, and more inclined forwards as it ascends: the plane of the occipital condyle is vertical, and the basioccipital extends further below the occipital condyle, though less so than in *Palapteryx*. In these characters the *Brachypteryx* or Short-winged Rail of New Zealand more resembles *Notornis*. The articular surface of the tympanic is divided, as in *Dinornis* and *Otis*, into two subcircular cups. The parietal region is singularly flat, the temporal fossæ unusually long, well-defined by ridges extending from the paroccipital to the postfrontal. In the comparatively small *Porphyrio* and *Brachypteryx*, in which, as in all small birds, the cerebral hemispheres, as requiring a certain bulk for their functions, do not decrease in the ratio of the size of the body, the upper surface of the cranium is raised by the hemispheres beneath into a smooth convexity.

The *Notornis* is a large modified form of the same natural family of the *Grallæ* as the *Porphyrio* and *Brachypteryx*, and from the form of its sternum it must have been, like the latter peculiar bird of New Zealand, deprived of the power of flight.

The fourth genus of bird indicated by portions of the skull in Mr. Walter Mantell's collection was referable to the family of Parrots (*Psittacidæ*), and amongst these to the genus *Nestor*. The bony portion of the upper beak—the only part of the skull preserved—by its deep, subcompressed, curved and pointed form, its seeming solidity, pierced by small subcircular nostrils close to its base, attested the family character; whilst the proportional length as compared with the depth, the narrow upper surface to where it suddenly expands above the nostrils to join the cranium, the absence of the notch on the under border, the very narrow elongated triangular palatal sur-

face, with the median linear notch at its base,—all demonstrate that in this characteristic part of the skull the New Zealand bird represented by it most resembled the genus *Nestor*,—a singular nocturnal Parrot at present only known as a denizen of that island.

Thus then it appears that the indications of two genera, with several species of terrestrial birds of large or gigantic size, deduced in the Author's former Memoir (Part II.) from bones of the legs, are most fully and satisfactorily confirmed by the evidence of the subsequently received bones of the head and beak.

The form and structure of these characteristic parts in one of the genera (*Dinornis*) are so peculiar, that the author does not refer the genus to any known natural family of birds. Its location in the order *Struthionidæ* implies little more than an arrested development of wings, and an exaggerated development of legs, organized for progression on dry land.

As, however, there are strictly aquatic forms of birds deprived, by a low development and special modification of the wings, of the power of flight, so also there are, in other natural groups of birds, aberrant forms similarly debarred from the privilege and enjoyment of the characteristic kind and field of locomotion of their class. Apart from the true *Struthionidæ*, we have an instance of this in the *Brachypteryx* or modified Rail of New Zealand; the Dodo is a second instance, whether it be regarded as an aberrant Vulture or a modified Pigeon, according to the views entertained by Mr. Gould and supported, with new arguments, by Mr. Strickland, before the British Association at Oxford, and which will be fully elucidated in the forthcoming work on the extinct flightless birds of the Mauritius and neighbouring isles, which Mr. Strickland is about to publish in conjunction with Dr. Melville.

With regard to the natural group or family of birds to which the *Dinornis*, with its adze-like bill and crocoid cranium, may be referable, the author pointed out several marks of resemblance in the skeleton of the Bustard to the *Dinornis*, which are not presented by the skeletons of the true *Struthionidæ*. But he also dwelt upon the peculiar characters of the *Dinornis*, distinguishing it from the *Otidæ*, and indicating it to form a distinct family-type in the order of *Grallæ*.

With regard to the peculiar form of beak in *Dinornis*, reference was made to the deductions in the former memoirs, "from the unusual strength of the neck," that the *Dinornis* would be found to have a beak applicable "to a more laborious task than the mere plucking of seeds, fruits or herbage;" and that "the robust proportions of the cervical vertebræ, especially of their spinous processes, may have been the foundation of those forces by which the beak was associated with the feet in the labour of dislodging the farinaceous roots of the ferns that grow in characteristic abundance in New Zealand."

For this labour the beak of the *Dinornis*, formed after the model of the adze or pick-axe, seems peculiarly adapted, and the singular development in both breadth and depth of the occipital part of the

cranium, with its strongly marked ridges, processes and muscular depressions, is precisely calculated for the adequate attachment of the muscular masses arising from the cervical vertebræ.

The second form of cranium and beak, referred to the genus *Palapteryx*, indicates that genus to be a member of the true *Struthionidæ*, and by its affinities to have been intermediate between *Dromaius* and *Apteryx*.

The *Notornis* is a struthious or brevipennate form of the *Rallidæ*, intermediate between *Porphyrio* and *Brachypteryx*. The remains of the beaks of the Psittaceous bird are not distinguishable generically from those of the genus *Nestor* of New Zealand.

Thus, observed Prof. Owen, "those concordances in the geographical distribution of existing and recently extinct forms of the warm-blooded vertebrate classes which are illustrated by the remains of Elephants, Rhinoceroses, Hippopotamuses, Hyænas, large Bovines and Cervines, in the pleistocene deposits of Asia and Europe,—by the absence of these and the presence of gigantic extinct Sloths, Armadillos and Anteaters, in the coeval deposits of South America, and of huge fossil Kangaroos, Wombats and Dasyures in the bone-caves and freshwater deposits of Australia,—have received new and striking elucidations from the repeated discovery, in the cavernous fissures, turbaries, and river-beds of New Zealand, of the remains of gigantic forms of birds allied to those small species, *Apteryx* and *Brachypteryx*, which constituted the highest representatives of the warm-blooded classes in the island, until the advent of Man led to the introduction of its present terrestrial mammals."

The author in conclusion repeated his acknowledgments to Dr. Mantell for the prompt accordance of the privilege of examining and describing these rare and interesting remains and expressed his high sense of the scientific value of the labours by which that eminent geologist's intelligent and enterprising son, Mr. Walter Mantell, had made so great an addition to the materials for developing the natural history of New Zealand.

The memoir was accompanied with numerous drawings of the specimens described, which will form plates 52—56 of the third volume of the 'Transactions.'

On the conclusion of Professor Owen's communication, Dr. Mantell expressed his opinion, that although the specimens formerly sent to this country were obtained from the beds of rivers and mountain-streams, and were regarded by the gentlemen who collected them as of very recent date, in reality they belonged to a period of as high antiquity, in relation to the surface-soil of New Zealand, as the diluvium containing bones of the Irish Elk, Mammoth, &c. to that of England. He observed that Mr. Colenso, Mr. Taylor, and Mr. Williams, who sent to England the bones figured and described by Professor Owen in the 'Zoological Transactions,' vol. iii., agree in this remarkable fact, that in some places, where the loamy marl in which their specimens were found was observed *in situ*, it was covered by several feet of strata of marine and freshwater sand, gravel and

silt. The bones collected by Mr. Walter Mantell, among which were the crania and mandibles that formed the subject of Professor Owen's present communication, were all found imbedded in a loose pure sand, formed in a great measure of magnetic iron and minute crystals of augite and hornblende, the detritus of volcanic rocks. This sand has filled all the cavities and cancelli of the bones, but is not in any instance consolidated together: hence the bones are in the most beautiful state of preservation, and the most delicate processes entire. Dr. Mantell conceives that this bed of volcanic sand is a continuation of the deposit of sandy loam which occurs at the embouchures of the rivers along the west and east coasts of the North Island, in the localities that yielded the bones sent over by Mr. Williams and Mr. Taylor; and that in the higher regions of the same river-valleys, the detritus brought down by the mountain-streams from the volcanic chain whence they originate, is unmixed with the clay and silt of the lower alluvial tracts; for all the streams in these parts of the North Island rise from the lofty ridges of Mount Egmont and Tongariro. Dr. Mantell alluded to the fact, that along the sea-coasts and on the banks of the rivers Eritonga, Waibo, &c., there are horizontal terraces of boulders of trap-rocks fifty feet high; and that the small rocky islands of trachyte off the coast bear marks of wave-action to the height of 100 feet above the present sea-level. He mentioned other facts of a like nature in confirmation of his opinion, that since the Moas existed the surface of the country has been elevated many feet above the level of the sea, and that the present rivers and mountain-streams are flowing through channels cut into the ossiferous deposits; in like manner as the rivers of Auvergne flow through the newer tertiary marls and limestones containing bones of Mammalia, and those of England through the diluvial clay and loam in which are imbedded the remains of the large extinct Pachyderms, the Rhinoceros, Mammoth, &c. He deemed it probable that the last of the race of Moas were destroyed by the earliest inhabitants of New Zealand, as the Dodo was finally extirpated by the Dutch colonists of the Mauritius, and the Irish Elk by the early British or Celtic tribes; but he considered it evident that the bone-deposit was in the progress of accumulation ages ere man inhabited the country.

2. DRAFTS FOR A NEW ARRANGEMENT OF THE TROCHILIDÆ. BY JOHN GOULD, F.R.S. L.S. Z.S. ETC.

Genus HELIANTHEA.

Gen. char.—*Rostrum* longum, rectum vel sursum aliquantò tendens, cylindræcum. *Nares* basales, et plumis a rostri basi porrectis, obtectæ. *Alæ* mediocres, et validæ. *Cauda* mediocris, et occlusa, paululùm furcata. *Pedes* perparvi. *Tarsi* admodùm breves, et plumis induti. *Hallux* brevissimus.

Bill long, straight or inclining upwards, and cylindrical; nostrils basal and covered with the feathers advancing from the base of the bill; wings moderately long and powerful; tail of medium size and slightly forked when closed; feet very small; tarsi extremely short, and clothed with feathers; hind-toe the shortest.

Types, *Trochilus helianthea* and *Bonapartii*.

Remark.—Plumage of the males rich and beautiful in the extreme.

Hab. So far as is yet known, the Cordillerian Andes.

HELIANTHEA Eos (n. sp.), Aves, t. i. *Hel. mas, summo capite nigro, apud frontem notâ metallicè aureo-viridi; collo anteriore et pectore splendide aureo-viridibus; gutture centrali notam intensè cæruleam ferente.*

Male.—Crown of the head black, with a shining spot of metallic golden green on the forehead; fore-part of the neck and chest lustrous golden green, the golden green predominating on the lower part of the chest; on the centre of the throat a patch of rich deep blue; abdomen rich shining flame-colour; back, wing and upper tail-coverts bronzy orange; tail cinnamon-brown, the apical half of the two middle feathers and the tips of the remainder with a bronzy lustre; primaries chocolate-brown; secondaries reddish buff, forming a conspicuous mark on the wing.

Female.—Similar in colour, but much less resplendent, and entirely destitute of the spot of green on the forehead and the patch of blue on the throat.

Total length $5\frac{1}{4}$ inches; bill $1\frac{1}{2}$; wing $2\frac{3}{4}$; tail 2; tarsi $\frac{3}{16}$.

Hab. The highlands of New Grenada and Venezuela.

Remark.—Nearly allied to *H. Bonapartii*.

GENUS AGLÆACTIS.

Gen. char.—*Rostrum* sub-brevè, paululùm apud basin depressum, rectum. *Nares* basales. *Alæ* elongatæ, validæ; remigibus primariis falciformibus hâc formâ præcipuè apud primam pennam notandâ. *Cauda* mediocris, et occlusa, paululùm furcata. *Pedes* validi et robusti. *Tarsi* in partem plumis induti. *Hallux* cum ungue, digito medio cum ungue longior.

Gen. char.—Bill rather short, a little depressed at the base and straight; nostrils basal; wings long and powerful; primaries, particularly the outer one, sickle-shaped; tail moderately large and slightly forked when closed; feet strong and powerful; tarsi partially clothed with feathers; hind-toe and nail longer than the middle toe and nail.

Types, *Trochilus cupripennis* and *T. Pamela*.

AGLÆACTIS CAUMATONOTUS (n. sp.). *Ag. vertice et collo fuscis, loris, pectore, et partibus inferioribus cinnamomeis; gula fasciâ nigro-fuscâ trans-notatâ; lateribus nigro-fusco tinctis; plumarum penicillo elongato, et intensè fusco, sed ad apicem fulvo, apud pectus imum; alis æneo-olivaceis; caudâ cinnamomeâ, supernè æneo-olivaceâ; dorso caudæque tectricibus purpurascenti-liliaceis si plumæ contra lucem modo contrario in conspectu sint.*

Crown of the head brown; lores, chest and under-surface cinnamon-brown; throat crossed by a bar of blackish brown; flanks clouded with blackish brown; from the lower part of the chest springs a tuft of lengthened feathers, which are dark brown at the base and buff at the tip; wings bronzy olive; tail cinnamon-brown, except on the upper or exposed portion, which is rich bronzy olive;

back and upper tail-coverts shining purplish lilac, which colour is only seen when the feathers are looked at in the reverse direction.

Total length $4\frac{1}{2}$ inches; bill $\frac{7}{8}$; wing $3\frac{1}{4}$; tail $1\frac{3}{4}$; tarsi $\frac{3}{8}$.

Hab. Peru.

Remark.—Closely allied to *T. cupripennis*.

Genus HELIANGELUS.

Gen. char.—*Rostrum* rectum, æquè ac caput longum, cylindraceum, et ad basin aliquantò depressum. *Plumæ frontales* rostri basin non obtegentes. *Alæ* mediocriter validæ primariâ externâ falci-formi. *Pedes* mediocriter validi, halluce digitorum intermedium æquante. *Cauda* mediocris, subrotundata.

Gen. char.—Bill straight, about as long as the head, cylindrical, and slightly depressed at the base; feathers of the forehead not advancing upon the bill; wings somewhat powerful, outer primary sickle-shaped; feet moderately strong; hind-toe and nail the same length as the middle toe and nail; tail rather round in form and of medium size.

All the species of this genus are from the Andes, and distinguished by the extreme lustre of the throat, which in most of the species is bounded below by a gorget of white or buff.

Types, *Trochilus Clarisse*, *Spencei*, *amethysticollis*, and *strophianus*.

HELIANGELUS MAVORS (n. sp.), Aves, t. ii. *Hel. mas, fronte notam angustam intensè flammeam ferente, vertice corporeque superiore aëno-viridibus; gula intensè flammèa, lunulâ latâ fulvâ, subtùs circumscriptâ, abdomine intensius fulvo, lateribus viridi lavatis; crisso griseo-fulvo; alis purpurascenti-fuscis; caudæ rectricibus intermediis duabus aëno-viridibus reliquis aëno-fuscis, externis duabus ad apicem obscurè albis; tarsis intensè fuscis; rostro nigro-fusco.*

Male.—Crown of the head and all the upper surface bronzy green, except the forehead, on which is a narrow mark of deep fiery red; throat deep fiery red, bounded below by a broad crescent-shaped mark of buff, which colour, but of a somewhat deeper tint, pervades the whole of the abdomen, except the flanks, which are washed with green; under tail-coverts greyish buff; wings purplish brown; two middle tail-feathers bronzy green, the remainder bronzy brown, the two outer ones on each side obscurely tipped with white; tarsi dark brown; bill blackish brown.

Total length $3\frac{7}{8}$ inches; bill $\frac{3}{4}$; wing $2\frac{1}{2}$; tail $1\frac{5}{8}$; tarsi $\frac{1}{4}$.

Hab. The Cordilleras of Venezuela and New Grenada.

Genus THALURANIA.

Gen. char.—*Rostrum* capite longius, deorsùm curvatum, et paululùm apud basin depressum. *Alæ* breves, debiles. *Cauda* mediocris, furcata. *Tarsi* plumis induti, parvis, mollibus. *Hallux* cum ungue, digito intermedio cum ungue brevior.

Gen. char.—Bill longer than the head, curved downwards, and rather depressed at the base; wings short and feeble; tail moderately large and forked; tarsi clothed with feathers, small and delicate; hind-toe and nail shorter than the middle toe and nail.

Types, *Trochilus furcatus*, *nigro-fasciatus*, *Watertonii*, &c.

THALURANIA VIRIDIPECTUS (n. sp.). *Thal. corpore superiore aeneo-viridi, hoc colore in viridissimum vergente apud uropygium; rectricibus caudæ crissoque necnon caudâ metallicè cæruleo-nigrescentibus; alis purpurascenti-nigris; gutture et pectore splendide viridibus; abdomine fulgentè cæruleo; tarsi plumis albis indutis; rostro nigro.*

All the upper surface bronzy green, passing into bright grass-green on the lower part of the back; upper and under tail-coverts and tail steel bluish black; wings purplish black; throat and chest resplendent grass-green; abdomen bright blue; tarsi clothed with white feathers; bill black.

Total length $4\frac{1}{4}$ inches; bill 1; wing, $2\frac{1}{4}$; tail $1\frac{3}{4}$.

Hab. The Columbian Andes.

Remark.—Nearly allied to *Trochilus nigrofasciatus*.

CAMPYLOPTERUS OBSCURUS (n. sp.). *Camp. vertice, corpore superiore, rectricibusque caudâ quatuor intermediis viridibus; guld, partibusque inferioribus intense griseis; lateribus crissoque viridi lavatis; rectricibus caudæ externis utrinque nigris, duabus externis ad apicem griseis.*

Crown of the head, all the upper surface and the four middle tail-feathers green; throat and under surface dark grey; flanks and under tail-coverts washed with green; the three lateral tail-feathers on each side black, the two outer ones tipped with grey.

Total length $5\frac{1}{4}$ inches; bill $1\frac{1}{8}$; wing 3; tail 2.

Hab. River Amazon.

Remark.—Nearly allied to, but quite distinct from, *Campylopterus latipennis*.

TROCHILUS (— ?) **CALIGATUS**. *Troch. vertice, et corpore superiore viridibus, guld et corpore inferiore splendide viridissimis; alis purpurascenti-nigris; caudæ tectricibus et caudâ nitide metallico-cæruleis; crissi plumis eodem coloratis, albo fimbriatis; femoribus tarsisque plumis niveis indutis.*

Crown of the head and upper surface green; throat and all the under surface resplendent grass-green; wings purplish black; upper tail-coverts and tail bright steel-blue; under tail-coverts the same, fringed with white; thighs and tarsi clothed with snow-white feathers.

Total length $3\frac{1}{2}$ inches; bill $\frac{7}{8}$; wing $2\frac{1}{8}$; tail $1\frac{3}{8}$.

Hab. New Granada.

Remark.—Nearly allied to *Trochilus Saucerotii* and *T. erythronotus*.

Genus OXYPOGON.

Gen. char.—*Rostrum capite brevius, debile et rectum. Genæ supra subtusque rostrum plumis elongatis ornatæ; illis supra erectis, his subtus pendentibus. Alæ paululò longæ. Cauda ampla et occlusa, furcata. Pedes ampli et validi. Tarsi nudi. Hallux cum ungue longior digito, cum ungue intermedio.*

Gen. char.—Bill shorter than the head, feeble and straight; face both above and below the bill ornamented with lengthened plumes,
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the former erect, the latter pendent; wings rather long; tail large, and forked when closed; feet large and strong; tarsi bare of feathers; hind-toe and nail longer than the middle toe and nail.

Types, *Trochilus Guerinii* and *T. Lindenii*.

3. ON FASTIGIELLA, A NEW GENUS OF SHELLS OF THE LAMARCKIAN FAMILY CANALIFERA. BY LOVELL REEVE, ESQ.

The shell which I am about to describe, from the collection of Hugh Cuming, Esq., is of an entirely new form, differing generically as well as specifically from any of the class to which it belongs. It is of an elongated turreted growth, and may be said to partake in almost equal proportions of the characters of two genera somewhat removed from each other in the system, *Turritella* and *Cerithium*. As in *Turritella*, the shell is of a solid spirally-ribbed structure, without any indication of varices, a condition not to be found in *Cerithium*; whilst it possesses a character which excludes it from the family *Turbinacea*, in having a short umbilicated twisted canal, different from that of *Cerithium*, for the passage of an elevated fold of the mantle. At the base the shell is not much unlike some species of *Buccinum*, but it is remarkable for its elongated *Turritella*-like growth. It is, moreover, to all appearance the production of a carnivorous gasteropod, and more strictly referable to the Canaliferous tribe than the *Cerithia*, which, according to Deshayes, are vegetable-feeders, and partake in many instances of the freshwater habits of the *Melania*.

Unfortunately Mr. Cuming is not in possession of any information respecting the shell, either as touching the animal or its place of habitation, and it only remains to add the following description, with the hope that the attention of conchologists will be directed to a form which appears new and of much interest.

Class GASTEROPODA.

Order PECTINIBRANCHIATA.

Family CANALIFERA.

Genus FASTIGIELLA.

Testa elongato-turrita, basi contracta et umbilicata, aperturâ parvâ, canaliculatâ, canali brevissimo, subcontorto.

FASTIGIELLA CARINATA. *Fast. testâ lanceolatâ, anfractibus rotundatis, carinis tribus, earum interstitiis nitidè excavatis, spiraliter cingulatis; extus intusque albâ.*

Hab. — ? Long. $1\frac{3}{4}$ in.; lat. $\frac{5}{8}$ in.

On the characters of this species it may be remarked that there are ten forcibly developed keels to a whorl, all of which are concealed from the observer by the superposition of one whorl upon another excepting three, these being the most distant from each other.

